

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

Claim 1. (Currently amended): A resist pattern thickening material comprising:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733; and

pure water,

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, and~~

wherein the resist pattern thickening material is capable of thickening a resist pattern of ArF resist.

Claim 2. (Currently Amended): A resist pattern thickening material according to Claim 1, wherein the cationic surfactant is at least one of an ~~alkyl cationic surfactant, an amide quaternary cationic surfactant[[.]] YA-6 and [[an]] ester quaternary cationic surfactant SF-107.~~

Claim 3. (Currently Amended): A resist pattern thickening material according to Claim 1, wherein the amphoteric surfactant is at least one of ~~an aminoxide~~ amine oxide surfactant LDM and [[a]] betaine surfactant AB-35L.

Claim 4. Cancelled.

Claim 5. (Original): A resist pattern thickening material according to Claim 1, wherein the resist pattern thickening material has at least one of water-solubility and alkali-solubility.

Claim 6. (Original): A resist pattern thickening material according to Claim 1, wherein the resin is at least one of polyvinyl alcohol, polyvinyl acetal, and polyvinyl acetate.

Claim 7. (Original): A resist pattern thickening material according to Claim 1, wherein the resin contains polyvinyl acetal in an amount of 5% by mass to 40% by mass.

Claim 8. (Original): A resist pattern thickening material according to Claim 1, wherein the crosslinking agent is at least one of a melamine derivative, a urea derivative, and an uril derivative.

Claim 9. (Original): A resist pattern thickening material according to Claim 1, further comprising a water-soluble aromatic compound.

Claim 10. (Original): A resist pattern thickening material according to Claim 9, wherein a solubility of the water-soluble aromatic compound is 1 g or more thereof in 100 g of water of 25°C.

Claim 11. (Original): A resist pattern thickening material according to Claim 9, wherein the water-soluble aromatic compound has at least two polar groups.

Claim 12. (Original): A resist pattern thickening material according to Claim 11, wherein the polar groups are each independently selected from hydroxyl groups, carboxyl groups, and carbonyl groups.

Claim 13. (Original): A resist pattern thickening material according to Claim 9, wherein the water-soluble aromatic compound is at least one of a polyphenol compound, an aromatic carboxylic acid compound, a naphthalene polyhydroxy compound, a benzophenone compound, a flavonoid compound, a derivative thereof, and a glycoside thereof.

Claim 14. (Original): A resist pattern thickening material according to Claim 1, further comprising a resin containing an aromatic compound in a portion thereof.

Claim 15. (Original): A resist pattern thickening material according to Claim 14, wherein the resin containing an aromatic compound in a portion thereof is at least one of a polyvinyl aryl acetal resin, a polyvinyl aryl ether resin, and a polyvinyl aryl ester resin.

Claim 16. (Original): A resist pattern thickening material according to Claim 14, wherein the aromatic compound in the resin containing an aromatic compound in a portion thereof has at least one functional group of a hydroxyl group, an amino group, a sulfonyl group, a carboxyl group, and a derivative thereof.

Claim 17. (Original): A resist pattern thickening material according to Claim 14, wherein the resin containing an aromatic compound in a portion thereof has an acetyl group.

Claim 18. (Original): A resist pattern thickening material according to Claim 14, wherein a molar content of the aromatic compound in the resin containing an aromatic compound in a portion thereof is 5 mol% or more.

Claim 19. (Original): A resist pattern thickening material according to Claim 1, further comprising an organic solvent.

Claim 20. (Original): A resist pattern thickening material according to Claim 19, wherein the organic solvent is at least one of an alcohol solvent, a chain ester solvent, a cyclic ester solvent, a ketone solvent, a chain ether solvent, and a cyclic ether solvent.

Claim 21. (Currently amended): A resist pattern comprising:

a first layer of an ArF resist material, the first layer having a pattern; and

a second layer formed of a resist pattern thickening material, formed on the first layer,

the resist pattern thickening material comprising:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733; and

pure water[,,]

~~wherein the alkoxylate surfactant is at least one of an oetylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant.~~

Claim 22. (Previously Presented): A resist pattern according to Claim 21, wherein the resist material is at least one selected from the group consisting of an acrylic resist, a cycloolefin - maleic acid anhydride resist, a cycloolefin resist, and a cycloolefin - acryl hybrid resist.

Claim 23. (Currently amended): A process for forming a resist pattern, comprising:

forming a first layer of an ArF resist material; and

applying a resist pattern thickening material onto the first layer to thicken the first layer,

wherein the resist pattern thickening material comprises:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733; and

pure water[,,]

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant.~~

Claim 24. (Original): A process for forming a resist pattern according to Claim 23, wherein a developing process is carried out after the step of applying the resist pattern thickening material.

Claim 25. (Original): A process for forming a resist pattern according to Claim 24, wherein the developing process is carried out by using pure water.

Claim 26. (Currently amended): A semiconductor device comprising:
a pattern formed by using:
a first layer of an ArF resist material; and
a second layer of a resist pattern thickening material formed on the resist material,
wherein the resist pattern thickening material comprises:
a resin;
a crosslinking agent;
at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-

6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733; and

pure water[[,]]

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, an oleyl alcohol ethoxylate surfactant.~~

Claim 27. (Currently amended): A process for manufacturing a semiconductor device comprising:

forming a first layer of an ArF resist material on an underlying layer, the first layer having a pattern;

applying a resist pattern thickening material on the first layer; and

etching a portion of the underlying layer where the first layer is not formed,

wherein the resist pattern thickening material comprises:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-

6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733; and

pure water[[,]]

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant.~~

Claim 28. (Original): A process for manufacturing a semiconductor device according to Claim 27, further comprising:

applying a surfactant on the surface of the resist pattern to be thickened, before the step of applying the resist pattern thickening material.

Claim 29. (Currently amended): A resist pattern thickening material comprising;
a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733 [[at]] in an amount of 1.25 to 2.5 weight parts with respect to 100 parts of the resin; and

pure water[.,.]

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant.~~

Claim 30. (Previously Presented): A resist pattern thickening material according to Claim 29, wherein the resist pattern thickening material is capable of thickening a resist pattern of ArF resist.

Claim 31.. (Currently amended): A resist pattern thickening material comprising:

a resin;

a crosslinking agent;

at least one of a cationic surfactant, an amphoteric surfactant, and a non-ionic surfactant selected from the group consisting of an alkoxylate surfactant, a fatty acid ester surfactant, an amide surfactant, and an secondary alcohol ethoxylate surfactant SO-135, nonylphenol ethoxylate surfactant NP-675, phenol ethoxylate surfactant SP-12, sorbitan ester surfactant T-81, natural alcohol surfactant LB-53B, primary alcohol ethoxylate surfactant LO-7, ethylene diamine surfactant TR-704, natural alcohol surfactant LA-775, amide quaternary cationic surfactant YA-6, ester cationic surfactant SF-107, amine oxide surfactant LDM, betaine surfactant AB-35L, and alcohol surfactant B-733;

a water-soluble aromatic compound; and

pure water,

~~wherein the alkoxylate surfactant is at least one of an octylphenol ethoxylate surfactant, a lauryl alcohol ethoxylate surfactant, and an oleyl alcohol ethoxylate surfactant, and~~

wherein the resist pattern thickening material is capable of thickening a resist pattern of ArF resist,

wherein the water-soluble aromatic compound is at least one of a polyphenol compound, an aromatic carboxylic acid compound, a naphthalene polyhydroxy compound, a benzophenone compound, a flavonoid compound, a derivative thereof, and a glycoside thereof.